Sevenson Environmental Services, Inc.

May 25, 2012

Mr. Dana Bayuk, Project Manager
Cleanup & Portland Harbor Section
Oregon Department of Environmental Quality
2020 SW 4th Avenue, Suite 400
Portland, OR 97201

Subject: Response to DEQ/EPA Comments on NW Natural Revised Construction Design Report Appendix E on Source Control Treatment Plant

Dear Mr. Bayuk:

Attached please find NW Natural Gas and Sevenson's responses to the questions raised in DEQ and EPA's review comments dated April 5, 2012 on the subject document.

Please contact me if you have any questions at 404-814-9343.

Very truly yours,

Terence P Driscoll

Terence P. Driscoll, P.E., BCEE

Cc: Bob Wyatt

661454

NW NATURAL RESPONSE TO DEQ and USEPA COMMENTS on REVISED CONSTRUCTION DESIGN REPORT APPENDIX E (TREATMENT SYSTEM DESIGN) COMMENTS GROUNDWATER SOURCE CONTROL MEASURES DESIGN, NW NATURAL "GASCO" SITE

Regarding DEQ's statements on page 2, paragraph 3 of the April 5 comment letter. That paragraph recommends that construction of the the Fill WBZ trench be initiated within six months of Step 3. That paragraph is not consistent with the fourth paragraph on page six of DEQ's December 7, 2011 letter, which states the following.

> "For clarification, under any scenario construction of the interceptor trench should initiated within six months of starting up the Alluvium WBZ HC&C system for long term operation."

As stated in the January 31, 2012 revised source control Construction Design Report, NW Natural cannot commit to a schedule for construction until the necessary additional site investigations and evaluations are completed.

GENERAL COMMENTS

Overall Treatment System Design. The Treatment System Design states on page 3 that NW Natural based the design, in part, on analyses that, "…established the processes as effective in cost-effectively meeting Oregon DEQ's discharge standards." DEQ understands this statement to mean that NW Natural expects the treatment system to perform as well as the pilot system, including meeting all of the proposed discharge limitations (with the possible exception of "total cyanide"). NW Natural should confirm, clarify, or correct DEQ's understanding.

DEQ's understanding is correct as stated: NW Natural expects its treatment system to perform as well as the pilot system including meeting all of the proposed discharge standards with the possible exception of total cyanide, for which NW Natural and its consultants are proposing a mixing zone. The application is currently being worked through Rob Burkhart with the DEQ.,

Sources of Water to the Treatment System. As discussed during the November 21, 2011 meeting and indicated in DEQ's December 7, 2011 letter, the treatment system design should clearly identify the individual sources of water, including their associated range of flow rates, to be collected and routed to the treatment system. DEQ made the request because although Attachment A of Appendix E in the Revised Interim Design discussed this information from a treatment system perspective, it did not communicate the information in a manner understandable in the context of the report overall. In a letter dated December 21, 2011, NW Natural agreed to revise the design document to include the information requested by DEQ.

Table 1 below sets forth and summarizes the three design conditions and all flows associated with those conditions:

Table 1: NW Natural Source Control Treatment Plant Design Flow

DESIGN PLANT FLOW SUMMARY			
	Avg Day	***Max Day***	***Peak Hour***
NW Natural Wells			
NW Natural Wells	***208***	***281***	***320***
Interceptor Trench	***20***	***27***	***31***
LNG Basin	***22***	***30***	***34***
U.S. Moorings[1]	***60***	***81***	***92***
Various DNAPL Wells	***50***	***68***	***77***
Miscellaneous NW Flows	***18***	***24***	***28***
Subtotal NW Natural	***378***	***510***	***581***
Siltronic			
Siltronic	***52***	***70***	***80***
Add'l Siltronic Wells	***25***	***34***	***38***
Misc Siltronic Flows	***4***	***5***	***6***
Subtotal Siltronic	***81***	***109***	***124***
Total Influent Flow	***459***	***619***	***706***
Internal Recycle Flows	***8***	***47***	***111***
Total Flow	***467***	***666***	***817***

[1] – This hypothetical flow volume was modeled in response to DEQ comments and is included only as a conservative design contingency and does not reflect an evaluation of any specific future system expansion.

Based on DEQ's review, the Treatment System Design does not address DEQ's request. It appears Attachment A is again intended to communicate this information. In the interest of moving the project forward DEQ attempted to extract the requested information from Attachment A. Based on our review of Attachment A, DEQ understands the treatment system is designed based on the maximum daily flows associated with at least six influent sources, including extraction wells, "US Moorings flows," "DNAPL wells," the "LNG basin," the "interceptor trench," and "spent back wash returns." DEQ further understands the following

- The groundwater component of the design flows for the "DNAPL Wells" is 68 gallons per minute (gpm).
- The total flow rate of 81 gpm estimated for the "US Moorings Influent" represents the combined contribution of the groundwater from the Fill WBZ and the Alluvium WBZ.
- The combined estimated flow rate for the Fill WBZ interceptor trench shown in the Construction Design (see Appendix J) is equal to the combined flows from the "LNG basin" and the "interceptor trench" (i.e., 57 gpm).
- The total maximum daily design flows for the Alluvium WBZ extraction wells is the sum of the "PW flows" for the NW Natural and Siltronic pre-treatment plants and the DNAPL wells (i.e., 307 gpm).
- A specific design flow "safety factor" does not appear to be included in Attachment A, but may be built into each of the flow estimates shown or into the overall design.
- The Construction Design indicates the total steady-state flow estimated for the HC&C system is 260 gpm of which 65 gpm is attributed to extraction wells connected to the Siltronic pre-treatment facility (PW-1U/L, PW-2U/L, PW-3U/L, and PW-11U); and 195 gpm to the wells connected to the NW

Natural pre-treatment facility (PW-4U/L, PW-5U/L, PW-6U/L, PW-7 through PW-10, and PW-12 through PW-14). Based on this information and not knowing how or whether a safety factor is built into the design, DEQ understands the difference between total steady-state flows (i.e., average daily flows) and the maximum design flows for the extractions wells is approximately 45-50 gpm.

NW Natural should confirm, clarify, or correct these understandings. In addition, for DEQ's information the DNAPL Wells should be identified and the difference between total steady-state flows and maximum design flows should be discussed in terms of the excess capacity of the treatment system available for contingencies (e.g., increasing extraction well flow rates, adding extraction wells to the network).

The Average Day flows for each well were initially developed from modeling performed by Anchor Qea on behalf of NW Natural. Note that the hypothetical US Moorings flow volumes were modeled in direct response to a DEQ comment, that they are presented as a conservative design contingency and do not reflect a commitment of any specific future system expansion.

An additional 5% contingency allowance, called "Miscellaneous Flows" was added to calculate the Average Day flow. A conservative Maximum Day: Average Day peaking factor of 1.35 was applied to the Average Day Flows. The Maximum Day flows were used to size most process equipment, with the exception of the plant pumping equipment, which used the Peak Hour flow rate.

The Peak Hour Flow was arrived at by applying a 1.3 peaking factor to each hour of the Maximum Day flow with a tidal variation. This resulted in a peaking factor of 1.54 times Average Day flow.

Waste Stream Determination. DEQ does not approve any of the portions of the Treatment System Design discussing treatment system wastes (e.g., DNAPL, oil, floatables, sludges, filter press cake) and/or their management. As indicated in DEQ's March 26, 2010 letter commenting on the Interim Design and our September 22, 2011 letter commenting on the Revised Interim Design, DEQ considers the Treatment System Design to be incomplete without specific information being provided about each waste stream produced by treating contaminated surface water and/or groundwater that is collected and routed through the treatment system. For clarification, this includes each waste stream (solid or liquid) for the NW Natural and Siltronic pre-treatment facilities and the main treatment plant.

The Waste Stream Determination should identify and determine the regulatory status of each waste stream (e.g., solid waste, hazardous waste [listed, characteristic]), provide the basis for each regulatory determination (e.g., regulatory citation, knowledge of process, sampling data), and include a plan for managing each waste stream. For clarification, DEQ expects that where sampling and analytical data are needed to determine the regulatory status of waste streams, the Waste Stream Determination will provide an approach for characterizing the waste streams, including a proposal for managing the wastes on an interim basis pending determination of its regulatory status.

The Treatment System Design should be revised to indicate a draft Waste Stream Determination which includes all of the elements identified above, will be developed as a treatment system design and construction planning document. In addition, Figure 5-1 of the Construction Design should include the Waste Stream Determination as a line item and indicate the draft document will be submitted for review by July 31, 2012. Furthermore, in responding to this letter DEQ requests NW Natural to:

Provide a list of each and every waste stream to be generated by the NW Natural and Siltronic pre-treatment facilities and the main treatment plant; and

Table 2 on the next two pages provides a listing of each waste stream as requested.

Clearly indicate each waste stream and the associated waste on drawings FD-2 through FD-5.

Waste streams are already identified on the Process Flow Diagram and Materials Balance (FD-1). It is not normal engineering practice to duplicate information on Piping and Instrumentation Diagrams.

NW Natural and Siltronic should be advised that the Waste Stream Determination must be completed before operation of the treatment system can occur.

See Table 2.

Cyanide Destruction Process. NW Natural's NPDES application supplement dated January 2012[3], states on page 15 that, "The selected cyanide destruction process is chemical oxidation using either hydrogen peroxide or sodium hypochlorite, depending upon which is found to be most effective." The application supplement also states that the treatment plant will be capable of using either chemical. It is unclear to DEQ whether and/or how this capability has been incorporated into the treatment system design. For example, will the lay-out of the main treatment system building allow for changing out cyanide destruct chemicals and equipment, or does the presence of two cyanide destruct reactors shown in Drawing FD-11 indicate both chemical oxidation processes are built-in to the system? NW Natural should provide information to address each of DEQ's questions and comments.

The chemical addition point and in-line mixing is the same for both hydrogen peroxide or for sodium hypochlorite. However, only one chemical will be used. Initially, sodium hypochlorite will be used. Whichever chemical is used will be stored in the same area, and fed to the system with a chemical feed pump which will be controlled in the same way.

Besides changing out chemicals and equipment, the Treatment System Design does not describe conditions or discuss criteria under which the change in chemicals would occur. For example, to what extent would operational changes in the cyanide destruct reactor (e.g., contact/detention time, dose) be adjusted before chemicals are changed-out? Based on Drawing FD-4, DEQ understands the cyanide destruct step will initially rely on sodium hypochlorite. DEQ further understands that following a limited evaluation period if the concentrations of "total cyanide" are not consistently meeting the conditions specified in the NPDES permit, then the alternative oxidant (hydrogen peroxide) will be used and similarly evaluated. NW Natural should confirm, clarify, or correct DEQ's understandings and describe the conditions under which chemical usage would change.

Only one chemical will be used. Based upon the pilot studies and bench-scale studies, NW Natural will initially use sodium hypochlorite for cyanide oxidation. The option to use hydrogen peroxide in place of sodium hypochlorite would only be exercised in the event that cyanide destruction was unsatisfactory with sodium hypochlorite.

Table 2: Summary of Maximum Day Waste Streams for NW Natural Source Control Treatment Plant

Waste Stream	***Maximum Day Flow, Gals/Day***	***Regulatory Status***	***Basis for Determination***	***Proposed Sampling Program***
LIQUIDS				
Siltronic Influent	*190,339*	*May contain F002*	*Sample Data*	*Monthly composite*
Siltronic Oil-Water Separator Effluent	*190,339*	*May contain F002*	*Sample Data*	*As necessary*
Siltronic Air Stripper Influent	*190,339*	*May contain F002*	*Sample Data*	*As necessary*
Siltronic Air Stripper Effluent	*190,339*	*Likely will not contain F002*	*Sample Data*	*Weekly composite*
Siltronic Blower Exhaust Air	*Negligible*	*Will comply with ODEQ Air Quality Regulations*	--	*Monthly*
Siltronic Vapor Carbon Exhaust	*Negligible*	*Will comply with ODEQ Air Quality Regulations*	--	*Monthly*
NW Natural Influent	*752,281*	*Not hazardous waste*	*40 C.F.R. 261.24(a)*	*Monthly composite*
NW Natural Oil-Water Separator Effluent	*752,281*	*Not hazardous waste*	*40 C.F.R. 261.24(a)*	*As necessary*
NW Natural Air Stripper Influent	*752,281*	*Not hazardous waste*	*40 C.F.R. 261.24(a)*	*As necessary*
NW Natural Air Stripper Effluent	*752,281*	*Not hazardous waste*	*40 C.F.R. 261.24(a)*	*As necessary*
NW Natural Blower Exhaust Air	*Negligible*	*Will comply with ODEQ Air Quality Regulations*	--	*Monthly*

NW Natural Vapor Carbon Exhaust	*Negligible*	*Will comply with ODEQ Air Quality Regulations*	--	*Monthly*
Combined Flow to Settling Basins	*798,056*	*Not hazardous waste*	*40 C.F.R. 261.24(a)*	*As necessary*
Settling Basin Effluent	*976,976*	*Not hazardous waste*	*40 C.F.R. 261.24(a)*	*As necessary*
Cyanide Reactor Effluent	*977,002*	*Not hazardous waste*	*40 C.F.R. 261.24(a)*	*As necessary*
Primary Bag Filter Effluent	*977,002*	*Not hazardous waste*	*40 C.F.R. 261.24(a)*	*As necessary*
GAC Vessel Effluent	*977,002*	*Not hazardous waste*	*40 C.F.R. 261.24(a)*	*As necessary*
Secondary Bag Filter Effluent	*977,002*	*Not hazardous waste*	*40 C.F.R. 261.24(a)*	*As necessary*
Final Effluent to Willamette River	*946,459*	*Not hazardous waste*	*40 C.F.R. 261.24(a)*	*As required by permit*
RECYCLE FLOWS				
Spent GAC Backwash	*28,260*	*Not hazardous waste*	*40 C.F.R. 261.24(a)*	*As necessary*
Gravity Thickener Overflow	*9,106*	*Not hazardous waste*	*40 C.F.R. 261.24(a)*	*As necessary*
Filter Press Filtrate	*8,062*	*Not hazardous waste*	*40 C.F.R. 261.24(a)*	*As necessary*

SOLIDS				
Siltronic Air Stripper Vapor Carbon	*Negligible*	*May be F002 waste*	*Sample Data*	*When disposed*
NW Natural Air Stripper Vapor Carbon	*Negligible*	*Solid waste*	*Sample Data*	*When disposed*
Combined Treatment Plant Carbon	*87*	*Solid waste*	*Sample Data*	*When disposed*

Siltronic Oil Sump	*Unknown*	*May be F002 waste*	*Sample Data*	*When disposed*
NW Natural Oil Sumps	*Unknown*	*Solid waste*	*Sample Data*	*When disposed*
Settling Basin Sludge	*17,193*	*Solid waste*	*Sample Data*	*As necessary*
Gravity Thickener Underflow	*8,087*	*Solid waste*	*Sample Data*	*As necessary*
Filter Cake	*25*	*Solid waste*	*Sample Data*	*When disposed*

SPECIFIC COMMENTS

DEQ's specific comments and questions on the revised treatment plant design are provided below:

- As requested in our March 26, 2010 letter commenting on the Interim Design and our September 22, 2011 comments on the Revised Interim Design, NW Natural should provide documentation regarding management of solids generated during the treatment system pilot study for DEQ's information and completeness of reporting. If the information has been submitted previously, DEQ requests that NW Natural provide the citation for the document. The equation for precipitating manganese by air stripping shown on page7 appears to be incorrect (not balanced). DEQ believes the balanced equation is: $Mn^{+2} + 0.5O_2 + H_2O \rightarrow MnO_2 \downarrow + 2H^{+}$. NW Natural should evaluate any potential impacts this error might have on the mass balance information compiled in Attachment A. Attachment A should be revised accordingly.

The quantity of solids generation was not tracked during the pilot study. The sludge generation figures shown in the design report are based upon Sevenson's experience for this kind of wastewater, as well as that of its engineers. The manganese oxidation equation was for illustration purposes only, and was not used to calculate sludge quantities, which are affected by other ions present in the wastewater, pH, and alkalinity.

- DEQ understands that based on the results of the treatment system pilot study, the initial polymer to be used in the treatment system will be the anionic polymer AE843 from HYCHEM Inc. of Tampa, Florida. As requested in our September 22, 2011 comments letter, manufacturer's information should be provided for the polymer. For clarification, requested polymer information includes, but is not necessarily limited to physical and chemical properties, laboratory analyses, and MSDS sheets. This information should be attached to the revised version of the Treatment System Design.

The requested polymer data will be provided to DEQ under separate cover.

- DEQ acknowledges the relocation of the Main Treatment Building to the northern portion of the site near the former office building. That said, buildings housing the NW Natural and Siltronic pre-treatment facilities are located within former lampblack and/or effluent ponds waste management areas. The soils underlying these former MGP waste management areas exceed human health and ecological risk-based criteria. Furthermore, NW Natural and DEQ agree that the former effluent ponds waste management area (i.e., the Tar Ponds area) represents a hot spot of contamination for soil and groundwater. The final Construction Design Report should indicate a site development plan will be prepared that addresses contamination during site preparation and construction of the main treatment building, pre-treatment facilities, and all associated piping. DEQ expects recommendations regarding worker health and safety (e.g., vapor barriers) to be incorporated into the plan. The final Construction Design Report should also discuss the potential for building locations to interfere with and/or be an element of remedial action alternatives.

It is NW Natural's plan to initially construct the Pretreatment Facilities on the site utilizing a vapor barrier and a secondary containment berm as a part of each foundation. No buildings or enclosures are proposed for the Pretreatment Facilities. The operation of the facilities will be continuously monitored by the SCADA system, but the facilities will not be continuously manned.

Prior to commencement of the Uplands Remediation project, NW Natural will submit a feasibility study addressing DEQ's concerns and laying out its proposed course of action to remediate these areas and protect the health and safety of the workers. The Main Treatment Building was moved to its current area to address these concerns.

Through its contractor Sevenson Environmental Services, NW Natural will submit a site development plan under separate cover to DEQ specifying the methods and means of the proposed

construction, a health and safety plan for its workers during construction, and the details of the vapor barrier, foundation design, and containment pads. Also, the plan will show areas where contaminated soil may be disturbed or removed due to the installation of piping and utilities and will prescribe the methods for proper removal and disposal of this material.

Attachment A (Mass Balance). DEQ has the following comments regarding the information compiled in this attachment.

- Related to DEQ's general comment, it appears information on the cyanide destruction step is only provided for sodium hypochlorite (see page 33). NW Natural should include corresponding information for hydrogen peroxide. DEQ also recommends labeling both to indicate they represent two alternatives for treating cyanide.

As indicated earlier, it is NW Natural's intent to utilize sodium hypochlorite exclusively for cyanide oxidation, unless it is shown to be ineffective in doing so. Prior testing has shown sodium hypochlorite to be effective and we do not expect to use hydrogen peroxide unless full-scale experience determines the hypochlorite to be ineffective.

- Estimates of the quantities of solids produced during water treatment are shown on page 35, however, it does not appear potential wastes generated in the pre-treatment facilities is included in the estimate. DEQ considers the information to be incomplete without pre-treatment information. NW Natural should review the information shown and make revisions as appropriate.

The precise mass of LNAPL and DNAPL is not known. Much of this material will be removed in the Oil-Water Separators. All material captured in the Oil-Water Separators will be pumped to a separate tank, tested and disposed of or recycled as appropriate at approved offsite facilities.

The Air Strippers in the Pretreatment Facilities will also oxidize iron and manganese which should be the major solids produced there. These expected mass values are shown in the mass balance as being carried from the NW Natural Pretreatment Facilities to the Settling Basins where they are shown to be removed as described on Page 8.

With regard to Siltronic Pretreatment facilities, Page 10 describes the iron and manganese solids being tested daily initially for the presence of F002 waste before discharging to the NW Natural flow stream. As indicated on Page 10, the accumulated solids and floatables in the Siltronic Pretreatment Facilities will be first checked for the presence of F002 waste and disposed of accordingly, either by disposal as a hazardous waste, or pumped to the Combined Treatment Plant.

Attachment B (Drawings). DEQ's comments on drawings included in Attachment B are provided below.

- Drawing FD-1. Sodium hydroxide (NaOH) input should be added to the NW Natural oil-water separator effluent (similar to Siltronic pretreatment).

Drawings FD-2 through FD-6 are "modified" Process Piping and Instrumentation Diagrams (P&IDs), i.e. simplified for the presentation in the Final Design Report. They will be developed in greater detail prior to installation.

- Drawing FD-2. The text and drawings FD-1 and FD-4 show sodium hypochlorite introduced into the combined treatment system after flocculation and just prior to the cyanide destruct reactor. However, Drawing FD-2 appears to add another sodium hypochlorite injection point in the Siltronic pretreatment system. NW Natural should review Drawing FD-2 and confirm the sodium hypochlorite injection point shown is correct.

Noted

- Drawing FD-4. The drawing shows vapor venting from the cyanide destruct tanks into outdoor air. NW Natural should explain how hydrogen cyanide in vapor has been considered in the design shown, including whether monitoring is needed to confirm hydrogen cyanide is absent from vented vapors.

Sevenson considers the likelihood of hydrogen cyanide gas generation to be extremely remote, as the pH of the water will already be greater than 9.0 as a result of the pretreatment processes for iron and manganese removal. However, the SCADA system has been designed to monitor ORP and pH in the Cyanide Destruct Reactors and will alarm if the pH were to drop below the desired range. At that point, the operator would manually adjust the pH back to the desired level. In addition, a Multirae "sniffer" will be employed to monitor hydrogen cyanide gas.

- Drawing FD-5. The label for "Waste Backwash to Influent" should be revised to read "GAC Filters to Spent Backwash Storage."

Noted

- Drawing FD-9-11. Additional information is needed regarding where and in what manner waste solids from the treatment system will be temporarily managed prior to waste characterization and appropriate off-site disposal.

Waste solids will be deposited in suitable containers and stored inside the facility until trucked off-site.

- Drawing FD-11. NW Natural should confirm there is adequate access and space within the Main Treatment Building if alternative cyanide treatment chemicals and/or equipment are employed.

Alternative treatment chemicals will not be used simultaneously, but sequentially. The same building storage space and feed equipment will be used for either chemical. However, sodium hypochlorite will not be stored with hydrogen peroxide.

NEXT STEPS

NW Natural should provide written responses to EPA's and DEQ's comments and a revised version of the Treatment System Design by May 22, 2012. Subsequent to EPA and DEQ determining our comments have been addressed, the final version of the Treatment System Design should be included in the final Construction Design Report.

The January 2012 Draft Final Design Report, as supplemented by these responses to review comments, is the final treatment system design The next step will be to procure long-lead time equipment and prepare assembly drawings.

Sevenson has contacted all of the vendors for the equipment and at this time (May) we believe that the lead time is 2-4.5 months, Final construction drawings showing installation details with selected equipment will be submitted to DEQ for review and final approval.

Please feel free to contact me with questions regarding this letter.

Sincerely,

Dana Bayuk
Project Manager
Portland Harbor Section

Attachments: EPA Comments

Cc: Patty Dost, Pearl Legal Group
John Edwards, Anchor QEA, LLC
Ben Hung, Anchor QEA, LLC
Rob Ede, Hahn & Associates
Terry Driscoll, Sevenson
Myron Burr, Siltronic Corporation
Tom McCue, Siltronic Corporation
Alan Gladstone, Davis Rothwell Earle and Xochihua
James Peale, Maul Foster & Alongi, Inc.
Sean Sheldrake, EPA
Lance Peterson, CDM
Jim Anderson, NWR/PHS
Tom Gainer, NWR/PHS
Henning Larsen, NWR/SRS
Rob Burkhart, NWR/WQ
ECSI No. 84 File
ECSI No. 183 File

EPA Comments on NW Natural and Siltronic
Wastewater Treatment Final Design Report
Dated January 2012

Comments dated April 4, 2012

The following are EPA comments on the January 2012 *NW Natural and Siltronic Wastewater Treatment Final Design Report*, prepared by Sevenson Environmental Services. This document is Appendix E to the *Revised Groundwater Source Control Construction Design Report* document also dated January 2012, and prepared by Anchor QEA, LLC on behalf of NW Natural.

General Comments

1. The design documents are fairly well defined at a conceptual process level with EPA's understanding per discussion with the Oregon Department of Environmental Quality (DEQ) that this design submittal represents progress somewhere in the preliminary design phase and that the final design will be performed prior to construction. EPA's understanding is that the primary intent of this design submittal is to allow for the procurement of certain long-lead items. EPA has not reviewed the design documents with respect to pilot testing data.

2. EPA's understanding is that the forthcoming final design submittal will adequately meet all applicable permit review/plan check requirements by appropriate permitting agencies.

3. EPA's understanding is that both EPA and DEQ will receive all relevant documents related to the following submittals:

- A full set of the Construction Bid Documents to include all Final Design drawings, specifications, calculations, and reports to include a Basis of Design Report or related documents
- An Operations and Maintenance Plan
- Construction progress and completion reports

This is not "conventional" project delivery involving facility planning, preparation of bid plans and specifications, competitive bidding to contractors, construction, transfer of ownership, operation by owner, etc. This is a Design-Build-Operate (DBO) project. There will be no Construction Bid Documents with Final Design drawings and specifications. Equipment will be procured and assembly drawings will be developed around the procured equipment in sufficient detail to allow construction. Calculations will not be included with the assembly drawings – this is the purpose of the Final Design Report. The basis of design is this Final Design Report – there is no separate Basis of Design Report.

An Operations and Maintenance Plan will be prepared prior to commencing operation.

Construction progress and completion reports are prepared as routine practice. These will be summarized and submitted to DEQ.

Specific Comments

Specific comments that relate to the report and design drawings are as follows:

1. Design Report, page 1 – paragraph 1 and page 2 – paragraph 1: The design report indicates that the pretreatment facilities for both the NW Natural Site (page 1) and the Siltronic Site (page 2) are to be installed inside a secondary containment area containing crushed stone over a 40-mil liner. Proper installation of this system will be critical to its integrity, reliability and longevity in preventing any plant leakage from becoming a subsurface release. Please provide more explanation on how this system will be installed to prevent damage to the liner, how the secondary containment may be

monitored, and how any potential leaks from conveyance or vessels will be identified.

It is NW Natural's plan to initially construct the Pretreatment Facilities on the site utilizing a vapor barrier and a secondary containment berm as a part of each foundation. No buildings or enclosures are proposed for the Pretreatment Facilities. The operation of the facilities will be continuously monitored by the SCADA system, but the facilities will not be continuously manned.

When the Uplands Remediation project begins, the Pretreatment Facilities will be moved as necessary to remediate the soils beneath them. Prior to commencement of the Uplands Remediation project, NW Natural will submit a feasibility study addressing DEQ's concerns and laying out its proposed course of action to remediate these areas and protect the health and safety of the workers. The Main Treatment Building was moved to its current area to address these concerns.

Through its contractor Sevenson Environmental Services, NW Natural will submit a site development plan under separate cover to DEQ specifying the methods and means of the proposed construction, a health and safety plan for its workers during construction, and the details of the vapor barrier, foundation design, and containment pads. Also, the plan will show areas where contaminated soil may be disturbed or removed due to the installation of piping and utilities and will prescribe the methods for proper removal and disposal of this material.

2. Design Report, pages 2 and 3 and Table 1: Please provide the sources of the influent flow estimates and peaking factors. The narrative indicates that the hydraulic and treatment components of the system have been conservatively sized using the Maximum Hour flow rates. Please describe if a safety factor was also used during sizing/design. Please also provide a description of how additional flows from potential expansion to the system (example–additional groundwater extraction wells or an additional interceptor trench, etc.) will be accommodated at all three facilities.

Table 1 below sets forth and summarizes the three design conditions and all flows associated with those conditions:

Table 1: NW Natural Source Control Treatment Plant Design Flows

DESIGN PLANT FLOW SUMMARY			
	Avg Day	***Max Day***	***Peak Hour***
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[1] – This hypothetical flow volume was modeled in response to DEQ comments and are included only as a conservative design contingency and do not reflect an evaluation of any specific future system expansion.

The Average Day flows were initially developed from modeling performed by AnchorQea on behalf of NW Natural. . Note that the hypothetical US Moorings flow volume was modeled in direct response to a DEQ comment and that they are presented as a conservative design contingency and do not reflect an evaluation of any specific future system expansion. An additional 5% contingency allowance called "Miscellaneous Flows" was added to calculate the Average Day Flow. A conservative Maximum Day: Average Day peaking factor of 1.35 was applied to the Average Day Flows. The Maximum Day flows were used to size most process equipment, with the exception of the plant pumping equipment, which used the Peak Hour flow rate.

The Peak Hour Flow was arrived at by applying a 1.3 peaking factor to each hour of the Maximum Day flow with a tidal variation. This resulted in a peaking factor of 1.54 times Average Day flow.

3. Design Report, page 7 – paragraph 2 and Sheets FD-2 and FD-3: Please provide the estimated loading of solids accumulation that is expected in the air stripper or the stripper-equalization wet well/sump based on the 6-week pilot test results.

A conservative stoichiometric ratio of 3: 1 lbs of solids produced per pound of iron and manganese has been applied. For Siltronic, this results in a Maximum Day solids loading of 164 lbs/day, or approximately 100 mg/L total suspended solids. For the NW Natural flows, approximately 2,520 lbs per day of solids would be expected at the Maximum Day flow, or

approximately 400 mg/L.

4. Design Report, page 8 – paragraph 3 and page 11 – paragraph 1 and Sheets FD-2 and FD-3: Please provide more information on the required vapor treatment to include what level of vinyl chloride (VC) is expected in the influent flow and what VC loading is expected in the effluent of the air strippers. Please demonstrate that additional treatment will not be needed to meet discharge requirements and explain how operators will monitor for breakthrough and maintain compliance with only one vessel. Lastly, please provide the basis for the 15% VOC mass loading and present any granular activated carbon (GAC) isotherms that have been generated.

Bench-scale studies of air stripping of the Siltronic wastewater were conducted prior to the pilot plant. An influent vinyl chloride value of 160 ug/L was reduced in repeated tests to less than 10 ug/L (the detection limit for the lab), using a variety of air stripping design parameters.

In the pilot test, an advanced oxidation process was tested, using hydrogen peroxide and ultraviolet light. The value of vinyl chloride in the Siltronic influent flow during the pilot plant ranged from 43.9 ug/L to 890 ug/L, with an average influent value of 535 ug/L. With one exception (1.2 ug/L), effluent values for vinyl chloride were less than 0.50 ug/L.

The 15% figure is based upon Sevenson's experience in other former MGP sites, and is particularly applied to SVOCs, which will be much more a factor than VOCs at this point in the process. In any event, the GAC vessels will be monitored for breakthrough. If the adsorption figure varies somewhat based upon a different mix of organics, the carbon replacement time may be shorter or longer than that indicated.

5. Sheets FD-1, FD-2, FD-3, and FD-4: Given that iron, manganese, and other co-precipitated inorganics may precipitate downstream of the air strippers, but not be removed until downstream at the inclined plate clarifiers, please indicate what provisions have been made to prevent accumulation of these solids in conveyance lines and vessels between these two treatment steps.

The conveyance lines are sized to produce self-cleansing velocities to keep solids in suspension. The wet well depths will vary from approximately 1 foot to approximately 6 feet which should remove most solids. In the event that solids deposition is a problem, the wet well walls will be gusseted, or an additional air line will be placed in the wet wells to keep solids in suspension.

6. Sheet FD-2: Please explain the intended functionality of the "Standby Bleach Addition" at the Siltronic Facility- it is shown on the piping & instrumentation diagram (P&ID) but not on the process flow diagram.

Sodium hypochlorite will be added to adjust pH, aid oxidation and precipitation, particularly of manganese, should air stripping prove inadequate.

7. Sheet FD-2: The order of the check valve and ball valve downstream of the air stripper discharge pump at the Siltronic facility should be reversed.

Noted

8. Sheets FD-2, FD-3, and FD-4: Please provide what provisions will be included for monitoring differential pressure across the various static mixers and for cleaning them as needed.

Specific measurement of differential pressure across static mixers is not usually provided as the mixers are designed at high velocities. Mixer clogging is extremely rare, and would be indicated by decreased performance and high discharge pressures of the centrifugal pumps upstream. In addition, the in-line mixers are bolted to a flange connection and can easily be removed and cleaned should it prove necessary.

9. Sheets FD-2 through FD-6: Please confirm that required provisions to protect process pumps from blocked lines, low suction conditions, overheating, and other conditions will to be completed during final design.

Pump motors, pump output, etc. will be monitored and controlled by the SCADA systems as well as observed on a daily basis by operations staff.

10. Design Report, page 14 – paragraph 4 and Sheet FD-4: Please describe if treatment is needed from the vapor-phase discharge of the cyanide treatment reactors and whether appropriate controls will be included during final design.

Treatment is not needed. Complete cyanide destruction is monitored by ORP analysis. Sevenson considers the likelihood of hydrogen cyanide gas generation to be extremely remote, as the pH of the water will already be greater than 9.0 as a result of the pretreatment processes for iron and manganese removal. However, the SCADA system has been designed to monitor both ORP and pH in the Cyanide Destruct Reactors and will alarm if the pH were to drop below the desired range or ORP were to drop. At that point, the operator would manually adjust the pH back to the desired level or adjust the sodium hypochlorite dosage to produce the desired ORP level. In addition, a Multi-rae "sniffer" will be employed to detect any hydrogen cyanide gas present.

11. Design Report, page 14 – paragraphs 4 and 5 and Sheet FD-4: pH monitoring and control within the cyanide removal process is important to achieve desired performance. The process narrative and drawings do not indicate any pH monitoring or control within the cyanide destruction process. Please add in this equipment or explain how the treatment process is expected to be reliable without pH monitoring and control.

The ORP loop also includes a pH monitor. pH monitoring and control will be provided.

12. Design Report, page 15 – paragraph 5 and Sheet FD-4: The design report states that a static mixer is located just downstream of where the sulfuric acid is injected into the main treatment line yet no static mixer is included in the P&ID. Please include the static mixer into the P&ID.

A static mixer will be provided.

13. Design Report, page 16 – paragraphs 5 and 6, Attachment A and Sheet FD-5: The operational strategy with regards to liquid-phase granular GAC vessels in the main treatment facility is not clear. Please describe what criteria will be used to determine breakthrough and need for change-out and how the vessel pairs will exchanged before the lag vessel is exhausted. Please also describe what safety factor will be used to avoid breakthrough. Also, the arrangement of the liquid-phase GAC vessels is not clear. Four liquid-phase GAC vessels are included in the main treatment plant process narrative, but the drawings only show two (as is the case for other processes). Also, the material balance indicates one GAC vessel will be backwashed at a time, and that four will be used in series.

Please provide clarification in both the narrative and the drawings. Please also provide the basis for the 15% volatile organic compound (VOC) mass loading on the carbon and if any GAC isotherms were generated to support this mass loading.

There are two GAC process trains operating in parallel. Each parallel train includes two reactor vessels in series, with each train capable of handling the Peak Hour flow, while the other train is backwashed. Pressure transmitters before and after each vessel will allow the SCADA system to monitor differential pressure and determine when backwashing is required due to particulate blinding.

Periodic monitoring of sample taps between the vessels will be performed to determine the point before breakthrough of the first vessel occurs. Valving flexibility allows the second vessel to be put in the first position while the carbon in the first vessel is replaced.

The 15% figure is based upon Sevenson's experience in other former MGP sites, and is particularly applied to SVOCs, which will be much more a factor than VOCs at this point in the process. In any event, the GAC vessels will be monitored for breakthrough. If the adsorption figure varies somewhat based upon a different mix of organics, the carbon replacement time may be shorter or longer than that indicated.

14. Sheet FD-11: The sodium hypochlorite and sulfuric acid feed systems appear to be stored in adjacent locations. Please explain the provisions associated with the chemical storage areas, including secondary containment, chemical metering process safety components, measures to keep incompatible chemicals from mixing, and any other provisions required for safety.

Portions of drawing FD-11, such as the chemical systems, are drawn out-of-scale for report presentation purposes. The space allocated for chemical storage and feed is over 1,100 square feet. The bulk storage totes will be arranged in separate containment bays. The acid and sodium hypochlorite bays will be separated by the polymer bay. A combination deluge shower and eye wash with flow alarm will also be located in the chemical area.

15. Sheet FD-11: Consider locating the backwash pumps closer to the vessels being backwashed and/or the backwash water supply.

Backwash pumps will be relocated as close as practicable to the backwash water supply in order to minimize suction loses and maximize available Net Positive Suction Head.